



# “From the Ground Up: Balancing the NSF Astronomy Program”

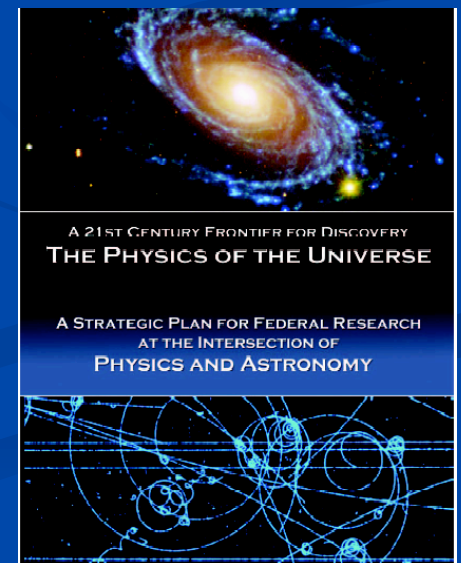
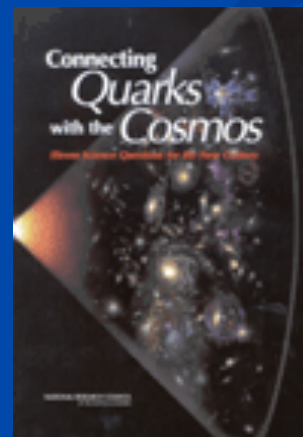
Senior Review Major Recommendations  
November 2006

# Outline

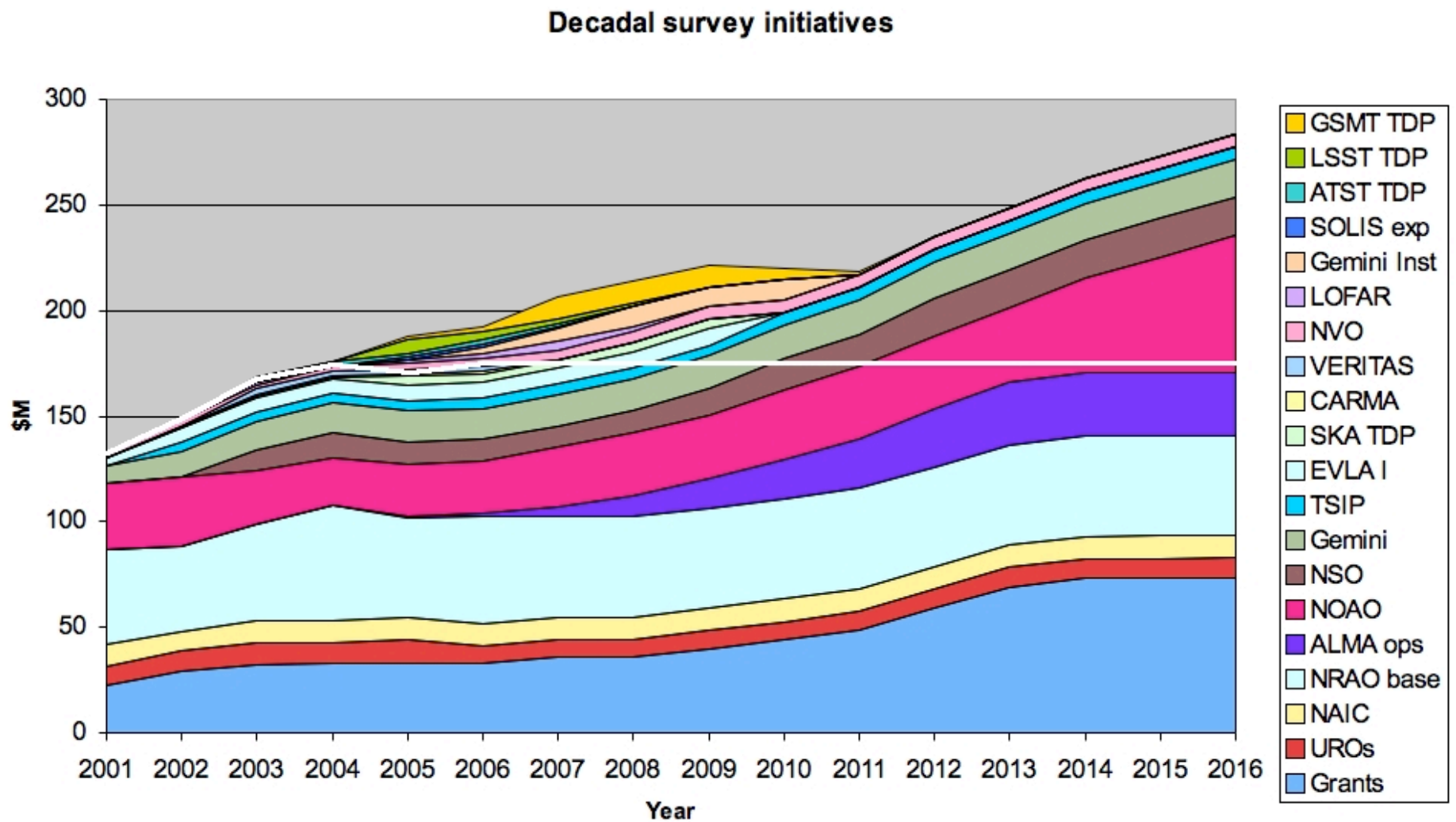
- Reminder of context and motivation for senior review
- Charge to the review
- Process of review
- Major recommendations
- Development of an implementation plan



# Projects Recommended in: Decadal Survey Quarks to the Cosmos Physics of the Universe and Emerging areas

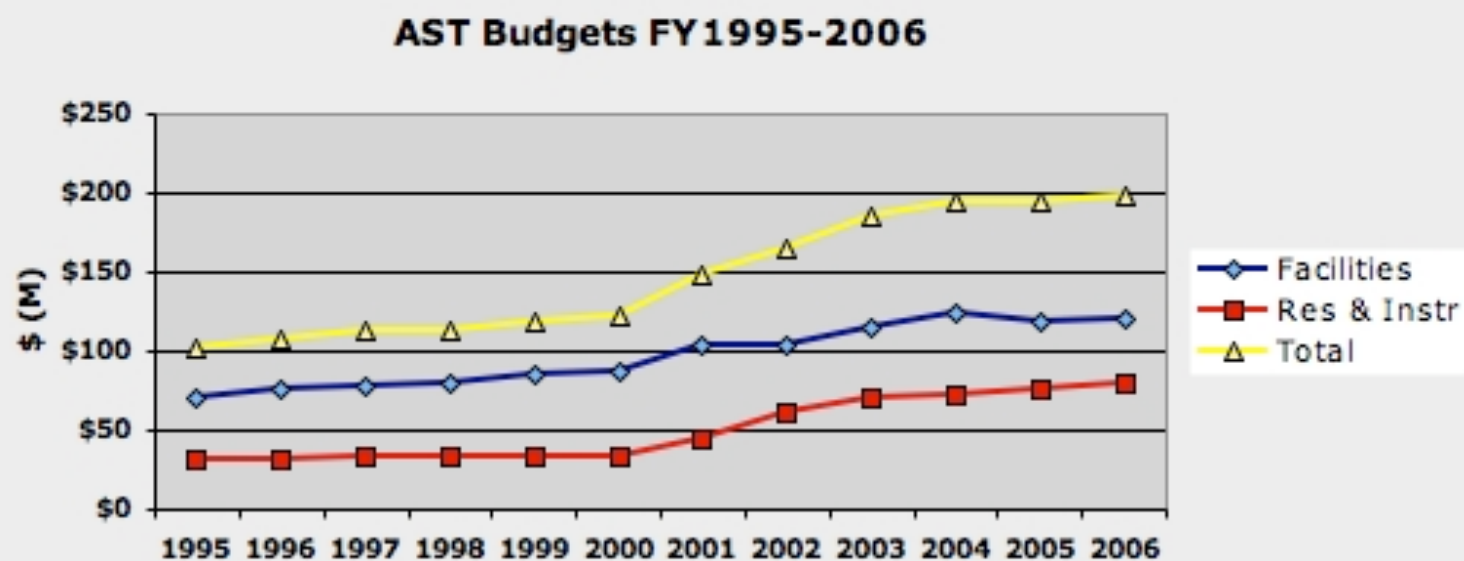


## Total of Decadal Survey recommendations





# AST Budget FY1995-2006





# “Senior Review”

- Responds to:
  - Decade Survey recommendation re: facilities
  - Calls for examination of balance in AST portfolio
- Made imperative by:
  - Budget outlook
  - Ambitions of the community
  - AST budget growth



# Senior Review

- Boundary Conditions
  - AST budget will grow no faster than inflation for the remainder of the decade
  - Unrestricted grants program (AAG) will be protected
  - New facilities reviewed only 5-10 years after becoming operational (Decadal survey recommendation)
  - Adjustments in balance must be realistic and realizable
  - Committee will not revisit priorities and recommendations of community reports
  - Committee will not consider individual projects or proposals or determine how funds are to be distributed
  - Recommendations must be based on well-understood criteria
  - Ample opportunity for community input



# Senior Review

- Charge
  - Examine impact and gains of redistributing ~\$30M of annual spending from AST funds
  - Obtained through selective reduction in operations of existing facilities and reallocation of instrumentation and development programs
  - Generate ~ \$30M per year by FY2011
  - Recommend appropriate balance between making progress on new projects and reinvesting in high priority components of existing programs and facilities
- Results will inform FY2009 budget development (i.e. change will not be visible immediately)
- Will be additional costs associated with reprogramming



# Stewardship and Science

- NSF is steward of ground-based astronomy
- Committee was asked to help us in that stewardship
- Fabric of science must be far deeper and richer than Decade Survey priority list
- Much of the structure is taken for granted
- Examine that fabric – be certain pulling a thread doesn't unravel it all
  - Scientific capability for the future
  - Broad community support for the program



# The Question

“The question for all of us is to judge whether these changes are viable and lead to a vital and sustainable future, or whether the pace and scope of change necessary to realize the cumulative aspirations of the community under severely constrained budgets are too drastic.”



# Process

- Discussion and planning within AST began summer 2004
- Committee established October 2005 as subcommittee of MPS Advisory Committee - Roger Blandford, Chair
- Report requested March 2006 but committee and community assured ample time for quality report, and they took that time
- Committee held 4 face-to-face meetings and 6 plenary telecons from October 2005 to July 2006, much email correspondence
- Community input to NSF and committee
  - NSF web site and email [http://www.nsf.gov/mps/ast/ast\\_senior\\_review.jsp](http://www.nsf.gov/mps/ast/ast_senior_review.jsp)
  - NSF held 7 regional town meetings
    - Boston, Minneapolis, Clemson, DC, Boulder, Berkeley, AAS meeting
- Draft report sent to 5 outside readers for review in September, factual information confirmed with facility managers and NSF
- Facility managers briefed on draft major recommendations, feedback provided to committee and taken into account
- Report submitted to MPS AC for acceptance at its 1-3 November 2006 meeting
- AST and Blandford have briefed NSF management, Congressional Staff, OMB, OSTP on the process and recommendations



# Committee Membership

- ◆ Tom Ayres - Colorado
- ◆ Donald Backer - UC Berkeley
- ◆ Roger Blandford - KIPAC/  
Stanford (Chair)
- ◆ John Carlstrom - Chicago
- ◆ Karl Gebhardt - Texas, Austin
- ◆ Lynne Hillenbrand - Caltech
- ◆ Craig Hogan - U. Washington
- ◆ John Huchra - Harvard
- ◆ Elizabeth Lada - U. Florida
- ◆ Malcolm Longair - Cambridge
- ◆ J. Patrick Looney - Brookhaven
- ◆ Bruce Partridge - Haverford
- ◆ Vera Rubin - Carnegie/DTM



# Outline of Committee Report

(<http://www.nsf.gov/mps/ast/seniorreview/sr-report.pdf>)

- Scientific landscape
- Principles and criteria for developing recommendations
- Description of Current Program
- Definition of Base Program - components of current program that should be preserved over the next five years
- Transition Program - components where significant changes are recommended
- General findings - Reflections on relationship between current and proposed program; advice to the community and to NSF



# Criteria for Recommendations: Six Principles

- ***Optimizing the Science.*** The prime criterion, when making difficult choices between operating existing facilities and investing in new ones, is maximizing the integrated science impact for the overall US financial investment.
- ***Optimizing the Workforce.*** The implementation of the proposed program should consider diverse workforce needs within the Division of Astronomical Sciences-supported observatory system and should provide for the training of the next generation of scientists and engineers.
- ***The Public Dividend.*** Public access to astronomical discoveries, the observatories that produce them, and the personnel who are responsible for them, is a critical part of the current AST program that must be maintained.
- ***Bridging Artificial Divisions.*** In order to complete its ambitious proposed program, it will be necessary for the entire astronomical community to work together and to combine its resources and strengths.
- ***Engaging the University Community.*** The US astronomical facilities and the US university enterprise should align to enhance the research and education activities of the entire system.
- ***Astronomy without Borders.*** The increasingly international character of astronomical research should be recognized and strategic cooperation should be pursued where advantageous or necessary in the construction and operation of next generation large facilities

# Finding 1 - The Scientific Challenge

NSF finds this the most important conclusion of the report:

“Proper maintenance of current facilities while simultaneously developing and beginning operation of the proposed new facilities is infeasible under any reasonable expectations for federal budget support based on past funding levels. The cuts that are proposed to the existing program are as deep as possible without causing irreparable damage and will only allow a start to be made on new initiatives.”





# Nature of the Conclusions

- Motivated by science considerations but organized by Optical/IR, Radio-millimeter-submillimeter and Solar components and technique-specific facilities
- Common component of Base Program - the Grants Program:  
*“The Division of Astronomical Sciences should anticipate that pressure on the grants program will intensify over the next five years and should be prepared to increase its level of support to reflect the quality and quantity of proposals.”*





# Executive Summary

## Optical-Infrared Program



# Optical-Infrared Program

- NOAO should lead the Optical-Infrared Base Program:
  - deliver community access to an optimized suite of high performance telescopes of all apertures in both hemispheres through
    - Gemini time allocation
    - management of TSIP
    - operation of existing or new telescopes at CTIO and KPNO or elsewhere
      - no further divestiture of CTIO or KPNO telescopes
      - one-time investment for deferred maintenance
      - possible construction of new telescopes with specialized instrumentation on good sites
      - possible arrangements with independent observatories for time on smaller telescopes
      - renew instrumentation
        - NOAO leads, provides management, support
        - University community implements
- Moderate aperture facilities and instrumentation regularly assessed by competitive review based on scientific merit



# Optical-Infrared Program

- Ongoing support of technology development at independent observatories through the Adaptive Optics Development and the Advanced Technologies and Instrumentation Programs.
- Gemini operations will continue through 2012. Decisions on new Gemini instrumentation and negotiations for operation beyond 2012 should be guided by a comparison with the cost, performance and plans of other large optical telescopes.
- Growth in support of a Giant Segmented Mirror Telescope and a Large Survey Telescope should be paced by Federal project choices and the schedule for Major Research Equipment and Facilities Construction account funding as well as progress by the partners in these projects.



# NOAO Transition Program

- NOAO should plan to:
  - Reduce its major instrumentation program
    - Transition to management and support
    - Head teams (industry, independents, universities)
  - Reduce its data products program
    - Support archiving and pipelines
    - GSMT, LSST costs to be paid by projects as they grow
  - Reduce administrative and science research staff costs over the next five years
  - Concentrate on executing its base program more efficiently



# Executive Summary

## Radio-millimeter-submillimeter Program



# Radio-millimeter-submillimeter Program

- The Base program should comprise
  - the Atacama Large Millimeter Array
  - the Green Bank Telescope
  - the Expanded Very Large Array (Phase I)
  - support for University Radio Observatories and technology research and development through the Advanced Technologies and Instrumentation program



# Radio-millimeter-submillimeter Program

- US participation in the international Square Kilometer Array program, including precursor facilities, should remain community-driven until the US is in a position to commit to a major partnership in the project.



# NRAO Transition Program

- Very Long Baseline Array
  - Seek partners who will contribute personnel or financial support to the operations of the VLBA by 2011.
  - Limit AST support to \$3M, close if remaining costs are not found elsewhere.
- Reduction in operating costs of GBT
- Reduction in the cost of administrative support
- Reductions in scientific staff costs





# NAIC Transition Program

- Taper to \$8M per year AST support over next 3 years
  - Concentrate on surveys
  - ~20% time for individual PIs
  - (Assumes ATM support at ~\$2M/yr continues)
- Seek other sources of support for operations
- By 2011, AST support limited to \$4M. If other support not sufficient to produce a viable operational model, recommends closure.



# Executive Summary

## Solar Program



# Solar Program

- The Base Program:
  - Synoptic Optical Long-term Investigations of the Sun (SOLIS)
  - Advanced Technology Solar Telescope (ATST)  
(based on committee assumption of construction)



# NSO Transition Program

- NSO should:
  - organize an orderly withdrawal of personnel and resources, including the SOLIS telescope, from Kitt Peak/Tucson and Sacramento Peak and start to close down operations at these sites as soon as ATST funding begins.
  - consolidate its management and science into a single headquarters as soon as possible.
  - Support of the Global Oscillations Network Group (GONG++) project should cease one year after the successful deployment of NASA's Solar Dynamics Observatory, unless the majority of operations support is found from other sources.

# A Note about Cost Figures

- Committee generated cost figures for operations from facility reports
- Committee has made its own estimates of “savings” and appropriate minimum operational costs
- Committee also recommends an independent cost analysis for each facility’s operations to establish actual figures

# A Note about Cost Figures

- Amount of 'savings' depends on
  - Success in finding partners to share operations costs
  - Detailed cost reviews of facilities
  - Costs of closure, termination, restoration of sites, etc
- Minimum savings of \$13M if partners found, \$20M if closure of VLBA, Arecibo, GONG++
- Additional savings in operations to be determined.



# Findings



# Finding 1 - The Scientific Challenge

- “Proper maintenance of current facilities while simultaneously developing and beginning operation of the proposed new facilities is infeasible under any reasonable expectations for federal budget support based on past funding levels. The cuts that are proposed to the existing program are as deep as possible without causing irreparable damage and will only allow a start to be made on new initiatives. The scientific promise of the proposed new facilities is so compelling and of such broad interest and importance that there is a strong case for increasing the overall AST budget to execute as much of the science as possible.”





## Finding 2 - The Operations Challenge

- “Major astronomical observatories typically take at least a decade to plan, construct and commission. They are usually operated for several decades. The full costs of operating, maintaining, upgrading, exploiting, and decommissioning them are many times the costs of construction. Realistic life cycle costing for the observatories that are under construction or consideration is an essential part of strategic planning.”



## Finding 3 - The Strategic Challenge

- “Construction on ATST may begin as early as 2009 (so as to be operational in 2014) and there is a strong scientific case for proceeding with the GSMT, the LST and the SKA projects as soon as feasible thereafter. A realistic implementation plan for these projects involves other agencies and independent and international partners. Some choices need to be made soon; others can await the conclusions of the next decadal survey. Much work is needed, scientifically, technically and diplomatically, to inform this plan.”



## Finding 4 - Towards a Coherent National Astronomy Enterprise

- “In order to meet the challenge of multi-billion dollar, ground-based optical-infrared and radio observatories, there will have to be strong collaboration between the federal and independent components of the US astronomical enterprise and firm leadership by AST. A high-level commission addressing optical-infrared facilities provides one way to start to bring together the diverse components of the national program to realize the full potential of the US system.”



## Finding 5 - Future Reviews

- “Balancing the demands of the current program against the aspirations of the future program is an ongoing obligation. The Senior Review process should be implemented as a standard practice within the Division of Astronomical Sciences and should be a consideration in the next decadal survey.”



# Developing an NSF Response and Implementation Plan

- AST will work closely with facilities to understand implications of recommendations as we consider possible implementation
- NSF will be active in encouraging and engaging in discussion with other possible partners in facility operations, including international partners and other funding agencies.
- AST will work with the community and NOAO to determine where re-investment in existing OIR facilities should occur and in the development of an integrated and coordinated “System”



# Developing an NSF Response and Implementation Plan

- AST is undertaking detailed cost reviews of each observatory necessary to understand where cost reductions can be made
  - Understand operational costs, appropriate staffing levels
  - Consider other operational and business models
  - Hope to complete within next 6 to 8 months
- Explore costs and legal issues associated with recommendations e.g. environmental, deconstruction, divestiture, termination costs – engaging outside studies over the next year
- Community input
  - Town meetings
    - At least 5 regional meetings to be scheduled (taking offers to host)
    - AAS Special Session, 7 January 2007, Seattle
  - Email input [astsenior-review@nsf.gov](mailto:astsenior-review@nsf.gov)
  - Talk to us
- Many changes will take several years to implement – Budget implications in FY2009

# From the Conclusion

- “It should be emphasized that, in none of the proposed actions can the facilities targeted be seen as redundant to the scientific enterprise. Instead, the SR is recommending reduced AST funding or closure of some telescopes that could be unique and productive for 20 years.”
- “These findings, which go beyond the SR’s charge, may appear defeatist to some. However, the SR developed the more optimistic view that, with *patience, cooperation and wise planning*, it will be possible to realize the promise of the next generation of major observatories.”

- AST Web site for the Senior Review:

([http://www.nsf.gov/mps/ast/ast\\_senior\\_review.jsp](http://www.nsf.gov/mps/ast/ast_senior_review.jsp))

- The Senior Review Report:

(<http://www.nsf.gov/mps/ast/seniorreview/sr-report.pdf>)